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A DEEP WELL AT EMPORIA.

By ALVA J. SMITH.

THE well under consideration was drilled by Roberds & Lane for the city of Emporia, which had provided funds for the purpose by the issuance of development bonds. The well was begun soon after the first of the year 1904, the contract calling for a depth of 2000 feet, or to the Mississippian limestone. In the prosecution of the work the contractors were very unfortunate, having to abandon two wells at their own expense.

The first well was lost on account of the drill stem breaking, leaving the bit in the well at a depth of about 700 feet, where it was never recovered, although several weeks were spent in fishing for it. In the other well, which was drilled twelve feet south of the first one, a lug of iron was encountered. After drilling out large quantities of iron, the well was shot three different times, in the hope that the obstruction would be dislodged, but it continued to cut the rope, injure their tools, and impede the drilling, till the well was abandoned at a depth of 890 feet. In this well a stratum of coal of considerable thickness was encountered at a depth of 714 feet. As there was a probability of this coal being of commercial value, preparations were made for more accurately determining its thickness in the third well, which was drilled thirty feet south of the second one.

Eight or ten oil barrels were secured for the reception of all the drillings to be taken from the well while passing through or near the coal, and a contract was made with the drillers requiring them to remove their tools, bail out and measure up the well with a steel tape as often as the city might require.

The same formations were penetrated in this well as the other two, and the ten-inch casing put down to a depth of 690 feet, and no water was encountered for the next fifty feet.

When the hard sandstone above the coal was reached, the special gas committee of the city council and I were notified, and the work from that time till the coal was passed was under our personal supervision. When the drill penetrated a soft stratum beneath the sandstone they bailed out, and found they were drilling in slate. The depth of the well was then taken with a steel tape and the drillers instructed to drill one foot and then bail out, which they attempted to do, but the spring of the rope let the drill down

through the soft material four feet. On removing the drill it was found covered with coal and the water taken from the well was black. All the material removed by the bailer was saved and washed out. The drillings from this run proved to be one-fourth coal and three-fourths slate and bituminous shale. They then made a run of one foot all in coal. The next run was four inches in depth, and there was a trace of fire-clay on the point of the bit when removed, indicating that it had reached the bottom of the coal.

The next run of six inches was made in fire-clay, the drillings being about one-half coal, which was carried down from above, as the bailer is so constructed that it does not remove all the drillings, but leaves about a foot of them in the bottom each time, which would necessarily be mixed with the drillings of the succeeding run.

The thickness of the coal as thus shown was twenty-eight inches.

Another estimate of the thickness of the coal was made in the following manner:

From the 4-foot run	665 cubic inches of coal was saved.
" 1-foot run	960 " "
" 4-inch run	288 " "
" 6-inch run	265 " "
Total	2,178

Dividing the total number of cubic inches saved by 960, the number of cubic inches saved from the one-foot run in pure coal, we have 2.27 feet, or $2\frac{1}{4}$ inches, as the total thickness of the coal.

An analysis of the coal yielded the following quantities:

Water.....	7.96 per cent.
Volatile matter.....	33.13 "
Fixed carbon.....	39.64 "
Ash	17.27 "
Total	100.00 per cent.

The coal cokes readily and leaves a reddish-brown ash.

A sample was sent to Prof. E. H. S. Bailey, of the University of Kansas, and the following report was received from him:

"Moisture.....	7.91 per cent.
Volatile and combustible matter.....	35.38 "
Fixed carbon.....	38.08 "
Ash	18.63 "
Total	100.00 per cent.

"The coal leaves a red ash and cokes quite readily. By comparing it with other Kansas coals which are mentioned in volume III of the Kansas Geological Survey, it is evident that in some characteristics this coal is like the Osage; others like one sample of Lansing coal analyzed. The chief objection to the coal is the high percentage of ash. E. H. S. BAILEY."

A number of fine, sharp sands, resembling oil and gas sands, were found, but all contained salt water, instead of the hydrocarbons sought.

The figures in the column at the left of the accompanying well section are the numbers of the consecutive strata from the top downward; those in the first column to the right show the thickness of the strata, and those in the second column to the right give the depth in hundreds of feet from the top downward.

The well is located on lot No. 50 Congress street, in the city of Emporia, at a surface elevation of 1130 feet above sea-level.

Samples of the drillings were taken for the city by William Campbell and placed in their regular order in glass tubes, which are now on exhibition in the museum of the Kansas State Normal School.

Careful laboratory tests of the samples were made to see that they were properly named, and from the results I am convinced that the apparent discrepancies in the logs of wells from the same locality are largely due to the inaccurate naming of the samples, as well as lack of care on the part of the drillers to observe and report changes that occur in the formation.

On comparison with the samples taken from the Madison well* I find it quite easy to correlate a great many of them by their lithological character. The two sections agree very closely down to the bottom of the Iola limestone, where, instead of the ninety-nine feet of shale found at Madison, we have but seventeen feet at Emporia, which practically throws the Garnett, Iola and Erie or Bronson limestones into one great series of limestone beds extending from the Lawrence to the Pleasanton shales, a depth of 400 feet.

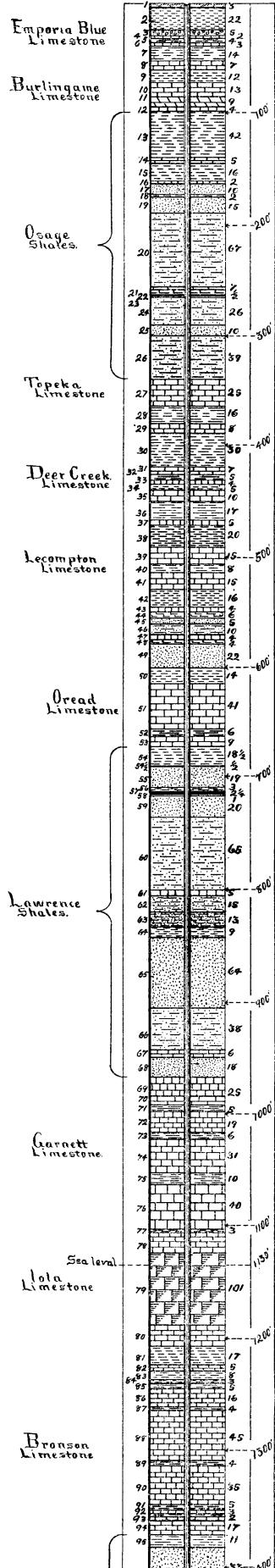
The Cherokee shales have a thickness of 356 feet, and the proportion of sand encountered is not greatly different from that in the Madison well.

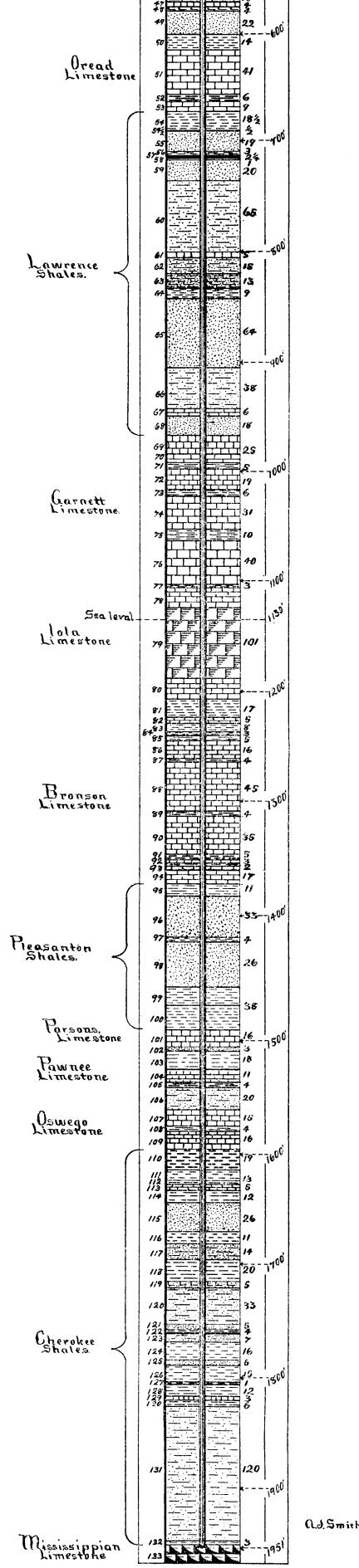
Good samples of the Mississippian were secured which prove that that formation retains its flinty character westward at least as far as Emporia.

A careful comparison of the reliable logs and the samples from the various deep wells in Kansas would be an interesting study that I doubt not would result in valuable information in regard to the character, thickness and extent of the various formations, and perhaps throw some additional light on the geological history of our state.

* See Trans. Kan. Acad. Sci., vol. XVI, p. 67.

EMPORIA WELL.





LOG OF A DEEP WELL AT EMPORIA, KAN.

No.	STRATA.	Thickness.	Depth.
1	Soil.....	3 feet.	3 feet.
2	Clay, light.....	22 "	25 "
3	Gravel; fresh water.....	5 "	30 "
4	Limestone, blue.....	2 "	32 "
5	Shale.....	4 "	36 "
6	Limestone, blue.....	3 "	39 "
7	Shale.....	14 "	53 "
8	Limestone.....	7 "	60 "
9	Soapstone.....	12 "	72 "
10	Limestone.....	13 "	86 "
11	Limestone, red, shaly.....	9 "	94 "
12	Limestone.....	4 "	98 "
13	Shale, blue.....	42 "	140 "
14	Limestone.....	5 "	145 "
15	Shale.....	16 "	161 "
16	Limestone.....	2 "	163 "
17	Sand.....	10 "	173 "
18	Shale.....	2 "	175 "
19	Sand, micaceous.....	15 "	190 "
20	Sandy shale, brown.....	67 "	257 "
21	Limestone and black shale.....	7 "	264 "
22	Coal.....	½ "	264½ "
23	Fire-clay.....	½ "	265 "
24	Shale, sandy.....	26 "	291 "
25	Sandstone.....	10 "	301 "
26	Sandy shale; dark salt water.....	39 "	340 "
27	Limestone, green streaks.....	25 "	365 "
28	Shale.....	16 "	381 "
29	Limestone.....	8 "	389 "
30	Shale, brown.....	30 "	419 "
31	Limestone; dark fossils.....	7 "	426 "
32	Shale, black, bituminous.....	5 "	431 "
33	Limestone, white.....	4 "	435 "
34	Shale.....	5 "	440 "
35	Limestone; <i>Fusulina</i>	10 "	450 "
36	Shale, green.....	17 "	467 "
37	Limestone, fossils, red in places.....	5 "	472 "
38	Shale, dark steatite.....	20 "	492 "
39	Limestone, blue.....	15 "	507 "
40	Shale.....	8 "	515 "
41	Limestone.....	15 "	530 "
42	Shale, steatite.....	16 "	546 "
43	Limestone.....	4 "	550 "
44	Shale, calcareous.....	6 "	556 "
45	Sand.....	5 "	561 "
46	Shale, sandy.....	10 "	571 "
47	Limestone, fossiliferous.....	4 "	575 "
48	Shale, dark, calcareous.....	4 "	579 "
49	Sand.....	22 "	601 "
50	Shale, blue.....	14 "	615 "
51	Limestone, with calcite crystals.....	41 "	656 "
52	Shale, black.....	6 "	662 "
53	Limestone, soft, white.....	9 "	671 "
54	Shale, slaty.....	18½ "	689½ "
54½	Coal.....	½ "	690 "
55	Sand, hard.....	19 "	709 "
56	Shale, slate.....	3 "	712 "
57	Coal.....	2 "	714 "
58	Fire-clay.....	1 "	715 "
59	Sand.....	20 "	735 "
60	Shale, sandy.....	65 "	800 "
61	Limestone, blue.....	5 "	805 "
62	Shale, sandy.....	15 "	820 "
63	Sand, and dark brown, lime fossils.....	13 "	833 "
64	Shale.....	9 "	842 "
65	Sand.....	64 "	906 "
66	Sandy shale.....	38 "	944 "
67	Limestone, white, crystallized.....	6 "	950 "
68	Sand.....	18 "	968 "
69	Lime, white, soft, granular.....	17 "	985 "
70	Lime, white, hard, calcite crystals.....	8 "	993 "
71	Slate; salt water.....	5 "	998 "
72	Limestone.....	19 "	1,017 "
73	Shale, soapstone.....	6 "	1,023 "
74	Limestone, white.....	31 "	1,054 "
75	Shale, soapstone.....	10 "	1,064 "
76	Limestone; fossils, undetermined.....	40 "	1,104 "
77	Shale, argillaceous.....	3 "	1,107 "

LOG OF A DEEP WELL AT EMPORIA, KAN.—CONCLUDED.

No.	Strata.	Thickness.	Depth.
78	Limestone, white, crystallized.....	18 feet.	1,125 feet.
79	Limestone, bluish, hard.....	64 "	1,189 "
80	Limestone, white.....	19 "	1,208 "
81	Shale, slaty	17 "	1,225 "
82	Limestone, white	5 "	1,230 "
83	Shale, green streaks.....	8 "	1,238 "
84	Shale, red, hard	3 "	1,241 "
85	Shale brown.....	5 "	1,246 "
86	Limestone, fossils.....	16 "	1,262 "
87	Shale, black, slaty.....	3 "	1,265 "
88	Limestone, brown and white.....	45 "	1,310 "
89	Shale, black, bituminous.....	4 "	1,314 "
90	Limestone, pinkish oolite; salt water.....	35 "	1,349 "
91	Slate, black, bituminous.....	5 "	1,354 "
92	Limestone, hard.....	3 "	1,357 "
93	Shale.....	2 "	1,359 "
94	Lime.....	17 "	1,376 "
95	Shale.....	11 "	1,387 "
96	Sand.....	33 "	1,420 "
97	Shale, argillaceous.....	4 "	1,424 "
98	Sand.....	26 "	1,450 "
99	Shale, red	16 "	1,466 "
100	Shale, green streaks.....	22 "	1,488 "
101	Limestone, gray; fossils, flinty.....	16 "	1,504 "
102	Sand, gray.....	3 "	1,507 "
103	Shale, green.....	18 "	1,525 "
104	Lime, dark.....	11 "	1,536 "
105	Shale, black	4 "	1,540 "
106	Sandy shale -.....	20 "	1,560 "
107	Limestone.....	15 "	1,575 "
108	Shale, slaty.....	4 "	1,575 "
109	Limestone, brown.....	16 "	1,595 "
110	Shale, black, bituminous	19 "	1,614 "
111	Shale, light	10 "	1,624 "
112	Shale, brown	3 "	1,627 "
113	Limestone, dark	5 "	1,632 "
114	Shale, slaty	12 "	1,644 "
115	Sand.....	26 "	1,670 "
116	Shale, brown.....	11 "	1,681 "
117	Sandy shale, dark.....	14 "	1,695 "
118	Shale, slaty	20 "	1,715 "
119	Shale, sandy, calcareous, hard.....	5 "	1,720 "
120	Shale, dark brown, sandy	33 "	1,753 "
121	Sand.....	5 "	1,758 "
122	Shale, black; bituminous coal.....	4 "	1,762 "
123	Sandy shale.....	7 "	1,769 "
124	Shale.....	16 "	1,785 "
125	Sand.....	5 "	1,790 "
126	Shale.....	15 "	1,805 "
127	Limestone, hard, dark	1 "	1,808 "
128	Shale.....	12 "	1,818 "
129	Limestone	3 "	1,821 "
130	Shale, black, slaty	6 "	1,827 "
131	Shale, dark gray, sandy	121 "	1,948 "
132	Shale, soapstone	3 "	1,951 "
133	Limestone, flinty, Mississippian		